IN THE CLAIMS:

1. (currently amended) A modulator for mapping a binary stream of bits onto a modulation constellation, the modulator comprising:

a symmetric spherical quadrature amplitude modulation constellation in a multi-dimensional complex plane, the constellation bounded by a surface further comprising all symbol points at a predetermined distance from a center point, coincident with an intersection of at least two axes, and corresponding in relative position to the symbol points on opposite sides of the axes; and

a mapper for mapping the binary stream of bits onto the symmetric spherical quadrature amplitude modulation constellation.

2. (previously amended) The modulator of claim 1, wherein the symmetric spherical quadrature amplitude modulation constellation further comprises:

B1 cont

N symbol points mapped in a two-dimensional complex plane identified by an in-phase and a quadrature axis, where $N = 2^n$ and n represents the number of bits in a binary word;

equidistant spacing between each N symbol point and its adjacent neighbor(s);

an innermost amplitude ring having four equally spaced symbol points;

at least one shell comprising n_{shell} amplitude rings where,

$$N_{shell} = \sqrt{N/4} \qquad \text{and} \qquad n_{pt,shell} = 4 + 8(n_{shell}-1)$$

where N_{shell} represents the total number of shells in the constellation, N represents the total number of symbols in the constellation, $n_{pt,shell}$ represents the number of symbols on the at least one shell identified by the shell index, n_{shell};

four diameters, passing through the origin. A first two of the four diameters intersecting at substantially 90°, and a second two of the four diameters intersecting at substantially 90°. The first two diameters rotated relative to the second two diameters at substantially 45°;

n_{shell} amplitude rings comprising 4 symbol points when the symbol points exist on the diameters;

n_{shell} amplitude rings comprising 8 symbol points when the symbol points exist off the diameter;

the N symbol points exhibiting eighth fold symmetry with point group type *4mm*.

B1 X
CON

3. (previously amended) The modulator of claim 2 wherein an "I" denotes the in-phase axis and a "Q" denotes the quadrature axis.

4. (previously amended) The modulator of claim 2, where n is an integer.

5. (previously amended) The modulator of claim 2, where *n* is a non-integer.

6. (previously amended) The modulator of claim 2, wherein the N symbol points further comprises:

an amplitude and a phase component for N/8 symbol points wherein the phase component of the symbol point, as identified by the location of the symbol point relative to the in-phase axis, is between 0° and 45°;

the amplitude and the phase component for the remaining (N – N/8) symbol points are such that,

(Ij, Qj) represents a symbol point, *j*, with a phase component of $0° \leq \theta \leq 45°$

(Qj, Ij) represents a symbol point, j, with a phase component of $45° < \theta \leq 90°$
(-Qj, Ij) represents a symbol point, j, with a phase component of $90° < \theta \leq 135°$
(-Ij, Qj) represents a symbol point, j, with a phase component of $135° < \theta \leq 180°$
(-Ij, -Qj) represents a symbol point, j, with a phase component of $180° < \theta \leq 225°$
(-Qj, -Ij) represents a symbol point, j, with a phase component of $225° < \theta \leq 270°$
(Qj, -Ij) represents a symbol point, j, with a phase component of $270° < \theta \leq 315°$.
(Ij, -Qj) represents a symbol point, j, with a phase component of $315° < \theta < 360°$

7. (currently amended) A quadrature amplitude modulation method comprising:

receiving a binary data stream of n bits at a rate of 1/T;

B1 Cont

segmenting the binary data stream to produce 2^n binary words comprising n data bits per binary word, where n is an integer;

mapping the binary words to ~~the~~ a symmetric spherical quadrature amplitude modulation constellation symbol points;

transmitting the symbol points over a transmission medium.

8. (original) The method of claim7, further comprising the step of encoding the binary data by error-correction means prior to segmenting the binary data stream.

9. (original) A quadrature amplitude modulation method, comprising the steps of:

receiving a binary data stream of n bits at a rate of 1/T;

encoding the binary data by error-correction means;

segmenting the encoded binary data stream to produce 2^n binary words comprising n data bits per word;

generating $2^n/8$ symbol points wherein the phase component of the symbol point is between 0° and 45°.

generating the remaining $(2^n - 2^n/8)$ symbol points by swapping of quadrature and in-phase component values and sign-change operations such that,

(Ij, Qj) represents a symbol point, j, with a phase component of $0° \leq \theta \leq 45°$
(Qj, Ij) represents a symbol point, j, with a phase component of $45° < \theta \leq 90°$
(-Qj, Ij) represents a symbol point, j, with a phase component of $90° < \theta \leq 135°$
(-Ij, Qj) represents a symbol point, j, with a phase component of $135° < \theta \leq 180°$
(-Ij, -Qj) represents a symbol point, j, with a phase component of $180° < \theta \leq 225°$
(-Qj, -Ij) represents a symbol point, j, with a phase component of $225° < \theta \leq 270°$
(Qj, -Ij) represents a symbol point, j, with a phase component of $270° < \theta \leq 315°$.
(Ij, -Qj) represents a symbol point, j, with a phase component of $315° < \theta < 360°$

B1 cont

mapping the symbol points in a symmetric spherical quadrature amplitude modulation constellation in a two-dimensional complex plane identified by an in-phase and a quadrature axis, comprising an innermost ring having four equally spaced symbol points, further comprising at least one shell comprising n_{shell} amplitude rings where $N_{shell} = \sqrt{N/4}$ and $n_{pt,shell} = 4 + 8(n_{shell}-1)$, where N_{shell} represents the total number of shells in the constellation, N represents the total number of symbols in the constellation, $n_{pt,shell}$ represents the number of symbols on the at least one shell identified by the shell index, n_{shell}, further comprising, four diameters, passing through the origin, a first two of the four diameters intersecting at substantially 90°, and a second two of the four diameters intersecting at substantially 90°, the first two diameters rotated relative to the second two diameters at substantially 45°, where n_{shell} amplitude rings comprise 4 symbol points when the symbol points exist on the diameters and n_{shell} amplitude rings comprise 8 symbol points when the symbol points exist off the diameter, the symbol points having equidistant spacing between symbol points and its adjacent neighbor(s) and the symbol points exhibiting eighth fold symmetry with point group type *4mm*;

mapping the binary words to the symmetric spherical quadrature amplitude modulation constellation symbol points;

transmitting the symbol points over a transmission medium.

10. (new) A modulator for mapping a binary data stream of bits onto a modulation constellation, the modulator comprising:

a symmetric spherical quadrature amplitude modulation constellation in a multi-dimensional complex plane, the symmetric spherical quadrature amplitude modulation constellation further comprising,

a first shell having an amplitude ring comprising a plurality of symbol points equidistant from the center point, and

B1 cont

a second shell having at least one amplitude ring, wherein the at least one amplitude ring comprises a plurality of symbol points equidistant from the center point and rotated 45° relative to the amplitude ring of the first shell; and

a mapper for mapping the binary data stream onto the symmetric spherical quadrature amplitude modulation constellation.

11. (new) The modulator of claim 10, wherein the at least one amplitude ring of the second shell comprises four symbol points equidistant from the center point.

12. (new) The modulator of claim 10, wherein the second shell comprises symbol points arranged to exhibit eight fold symmetry with point group type 4mm.

13. (new) A modulator for mapping a binary data stream of bits onto a modulation constellation, the modulator comprising:

a symmetric spherical quadrature amplitude modulation constellation in a multi-dimensional complex plane, the constellation further comprising, N symbol points mapped in a two-dimensional complex plane identified by an in-phase and a quadrature axis, where $N = 2^n$ and n represents the number of bits in a binary word; and

a mapper for mapping the binary data stream onto the symmetric spherical quadrature amplitude modulation constellation.

14. (new) The modulator of claim 13, wherein the symmetric spherical quadrature amplitude modulation constellation further comprises:

equidistant spacing between each N symbol point and its adjacent neighbor(s).

15. (new) The modulator of claim 13, wherein the symmetric spherical quadrature amplitude modulation constellation further comprises:

at least one shell comprising n_{shell} amplitude rings where,

B\ Cont

$$N_{shell} = \sqrt{N/4} \qquad \text{and} \qquad n_{pt,shell} = 4 + 8(n_{shell}-1)$$

where N_{shell} represents the total number of shells in the constellation, N represents the total number of symbols in the constellation, $n_{pt,shell}$ represents the number of symbols on the at least one shell identified by the shell index, n_{shell}.

16. (new) The modulator of claim 13, wherein the symmetric spherical quadrature amplitude modulation constellation further comprises:

four diameters, passing through the origin. A first two of the four diameters intersecting at substantially 90°, and a second two of the four diameters intersecting at substantially 90°. The first two diameters rotated relative to the second two diameters at substantially 45°.

17. (new) The modulator of claim 16, wherein the symmetric spherical quadrature amplitude modulation constellation further comprises:

n_{shell} amplitude rings comprising 4 symbol points when the symbol points exist on the diameters; and

n_{5shell} amplitude rings comprising 8 symbol points when the symbol points exist off the diameter.

18. (new) The modulator of claim 13, wherein the N symbol points exhibit eighth fold symmetry with point group type *4mm*.

19. (new) The modulator of claim 13, wherein an "I" denotes the in-phase axis and a "Q" denotes the quadrature axis.

20. (new) The modulator of claim 13, wherein *n* is a integer.

21. (new) The modulator of claim 13, wherein *n* is a non-integer.

B1 Cont

22. (new) The modulator of claim 13, wherein the N symbol points further comprises:

an amplitude and a phase component for N/8 symbol points wherein the phase component of the symbol point, as identified by the location of the symbol point relative to the in-phase axis, is between 0° and 45°;

the amplitude and the phase component for the remaining (N – N/8) symbol points are such that,

(Ij, Qj) represents a symbol point, *j*, with a phase component of $0° \leq \theta \leq 45°$
(Qj, Ij) represents a symbol point, *j*, with a phase component of $45° < \theta \leq 90°$
(-Qj, Ij) represents a symbol point, *j*, with a phase component of $90° < \theta \leq 135°$
(-Ij, Qj) represents a symbol point, *j*, with a phase component of $135° < \theta \leq 180°$
(-Ij, -Qj) represents a symbol point, *j*, with a phase component of $180° < \theta \leq 225°$
(-Qj, -Ij) represents a symbol point, *j*, with a phase component of $225° < \theta \leq 270°$
(Qj, -Ij) represents a symbol point, *j*, with a phase component of $270° < \theta \leq 315°$.
(Ij, -Qj) represents a symbol point, *j*, with a phase component of $315° < \theta < 360°$

23. (new) The quadrature amplitude modulation method of claim 7, wherein the step of mapping the binary words to a symmetric spherical quadrature amplitude modulation constellation symbol points, further comprises:

mapping the binary words to a constellation comprising a first shell having an amplitude ring further comprising a plurality of symbol points equidistant from the center point, and

a second shell having at least one amplitude ring, the at least one amplitude ring comprising a plurality of symbol points equidistant from the center point and rotated 45° relative to the amplitude ring of the first shell.

B1 Concl

24. (new) A modulator for mapping a binary data stream of bits onto a modulation constellation, the modulator comprising:

a symmetric spherical quadrature amplitude modulation constellation in a multi-dimensional complex plane, the constellation comprising a plurality of symbol points, wherein the symbol points exhibit eighth fold symmetry with point group type 4*mm*; and

a mapper for mapping the symbol points to the symmetric spherical quadrature amplitude modulation constellation.

25. (new) The quadrature amplitude modulation method of claim 7, wherein the step of mapping the binary words to a symmetric spherical quadrature amplitude modulation constellation symbol points, further comprises:

mapping the binary words to a constellation wherein the symbol points of the constellation exhibit eighth fold symmetry with point group type 4*mm*.